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This document provides an overview of the ABLE system, its mission, key components and an intended operational philosophy. The intent of this description is to enable the reader to gain a top level understanding of what ABLE is and how it may be used. The Advanced Building block for Large Area Exploitation (ABLE-1) is the integration of modern state-of-the-art digital radar exploitation concepts into a single system. ABLE demonstrates the increased throughput and responsiveness which digital technology allows and provides a number of previously unrealized operational advantages. These include (see reverse)

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Continuation of 20 Abstract

the ability to support near-continuous surveillance of the battlefield, to respond to tasking changes in the near real-time, to utilize multiple intelligence sources to direct exploitation and to rapidly exploit and report targets.

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1.0 INTRODUCTION

The Advanced Building block for Large area Exploitation (ABLE-1) (Figure 1-1) is the integration of modern state-of-the-art digital radar exploitation concepts into a single system. ABLE demonstrates the increased throughput and responsiveness which digital technology allows and provides a number of previously unrealized operational advantages. These include the ability to support near-continuous surveillance of the battlefield, to respond to tasking changes in the near-real time, to utilize multiple intelligence sources to direct exploitation and to rapidly exploit and report targets.

This document provides an overview of the ABLE system, its mission, key components and an intended operational philosophy. The intent of this description is to enable the reader to gain a top level understanding of what ABLE is and how it may be used.

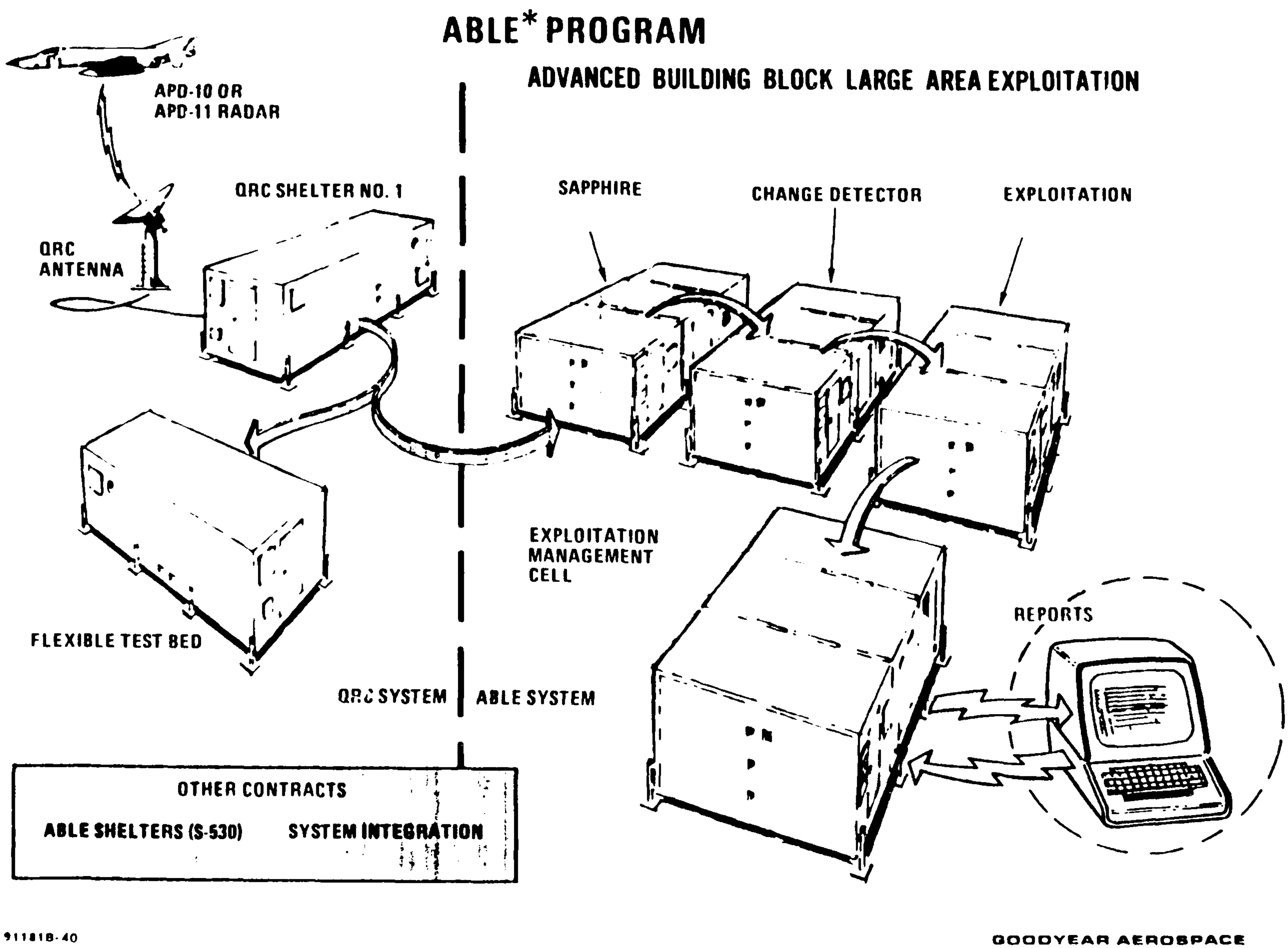

Figure 1-1 Major Functional Components of the ABLE System

2.0 MISSION

2.1 Concept and Evolution

The mission of the ABLE system is to validate developmental hardware, software, and operational concepts for the employment, management, and implementation of all-digital SAR processing and exploitation prior to fielding a production softcopy SLAR exploitation capability. The ultimate objectives of ABLE are timely and accurate exploitation with a very high throughput rate. Key elements include:

- Full swath, full resolution digital image formation for the RF-4 carried UPD-4/UPD-6 radars.
- Digital change detection with target cluster analysis for interpreter cueing.
- Automated exploitation management aids.
- High productivity (reports/hour).
- Digital map storage and display.
- Improved report timelines.
- Automated collateral data handling and presentation.

The ABLE concepts are a natural product of a continuous evolution in SLAR exploitation technology. The initial impetus for ABLE came from the addition of an air-to-ground data link, delayed real-time optical image formation (6 min.), and enhanced hard copy (film) exploitation hardware and software embodied in the QRC 7601 program. QRC 7601 Shelters 1 and 2 established the ability to detect, locate, and report on targets in

near-real-time using hard copy imagery displayed on cathode ray tube (CRT) displays. A companion set of equipment (QRC 7601 Shelter 3) demonstrated real-time all-digital image formation and advanced, two-stage softcopy exploitation techniques. The QRC 7601 equipment was supported by an elementary manual Exploitation Management Cell (EMC).

The Flexible Test Bed (FTB) was an enhanced Shelter 3 incorporating flicker change detection, buffering for two stage exploitation, a situation display and other improvements. The FTB clearly demonstrated the advantages of digital exploitation and was very successful in spite of limited radar processor resolution and 5 mile swath width.

The preceding hardware, software, and procedures demonstrated individual capabilities required to fully utilize the capabilities of a data link SAR system. The ABLE system brings together the full requisite capabilities simultaneously to provide a validated set of hardware, software, and procedures for the next generation of SAR reconnaissance systems.

2.2 Requirements

The goal of the ABLE system is the processing and exploitation of an average of 4000 NM^2 per hour of 10 ft UPD-4 SAR imagery and 16000 NM^2 per hour of 50 ft UPD-6 imagery. Average target report times (TOT-to-report transmitted) should be less than 5 minutes with a peak density of target areas analyzed of 100 per 1000 NM^2. Additionally, the ability to accurately locate targets in multiple coordinate systems within an accuracy of 100 meters is required.

2.3 Verification

The ABLE concepts will be validated in three separate tests or demonstrations. The first test is a limited CONUS acceptance test (less the ACDS) which is intended to verify required functionality. The second test is an operational demonstration in USAFE during the annual REFORGER exercise. This test is intended to validate the ABLE concepts and is the major objective of the program. The third test is a hands-on period of use by the Federal Republic of Germany (FRG) during a NATO exercise. This is intended to further verify ABLE concepts in a joint operational environment.

3.0 OPERATIONAL CONSIDERATIONS

The ABLE system, supplemented by a data link receiver, can operate as an independent, stand alone SLAR exploitation system. In practice, the stand alone ABLE system will operate as part of the overall USAF tactical reconnaissance system supporting both air and ground force commanders. This section will show how ABLE fits into this overall system.

3.1 Tasking and Reporting

ABLE's position in the European Tactical Reconnaissance request and reporting chain is shown in simplified form in Figure 3-1. Although there are many exceptions to the basic flow, the following description will illustrate how the process works nominally.

Most reconnaissance is performed in response to specific requests for battlefield information. These requests originate at the supported ground and air forces level and specify what area is of interest and what is of interest in that area. Requests are forwarded through channels to a centralized tasking authority (4ATAF) which consolidates and approves requests. Approved requests are then forwarded to the 26TRW as tasking. At the 26TRW Frag shop, these tasks are combined to optimize use of air assets and the combined tasking is written into a fragmentary order (Frag) which assigns specific air missions, sensor types and exploitation requirements. The Frag is then given to the 38th TRS operations section which assigns specific aircraft crews and flight times. The Frag also goes to the exploitation section for preparation of required materials and scheduling.

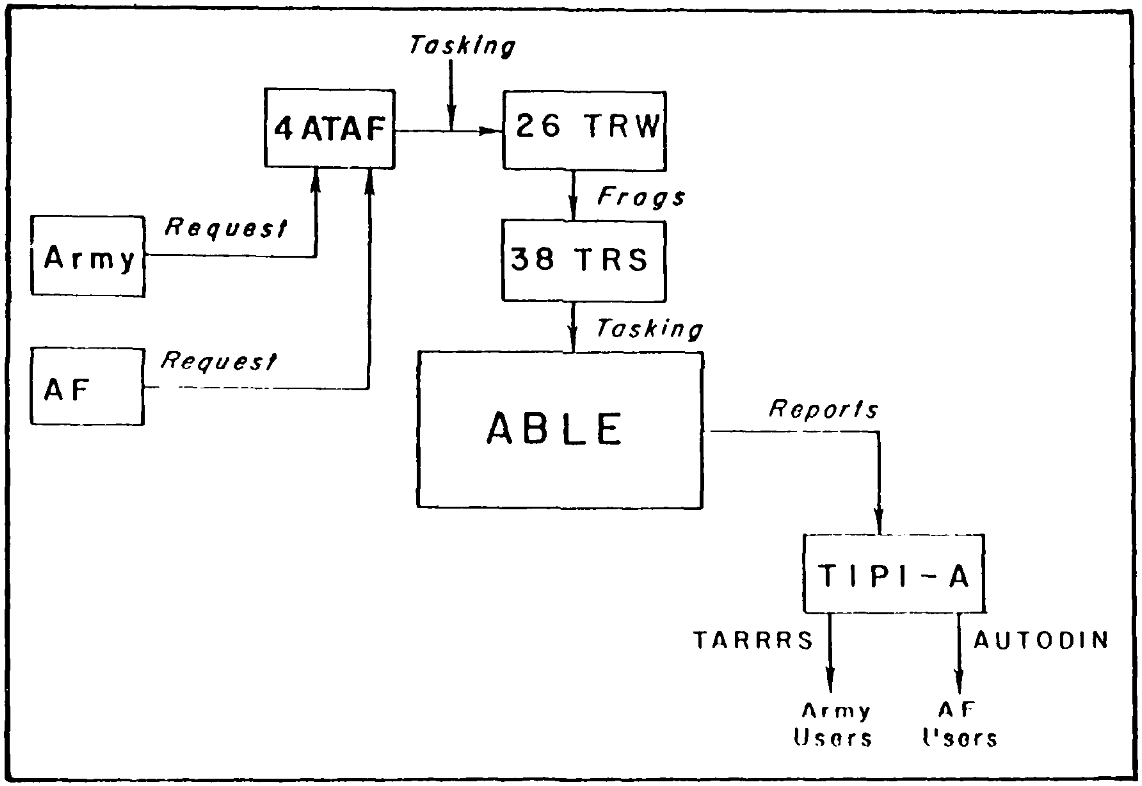

Figure 3-1 ABLE Tasking and Reporting Channels

Tasking may be received at anytime and Frags written in response. However, most reconnaissance requests are sufficiently routine so that the bulk of the Frags are received by the exploitation operations in the morning so as to allow planning for the entire day. However, there are constant changes throughout the day based upon such things as new requests, aircraft availability and weather.

The ultimate product of the air reconnaissance is the reconnaissance report which states what was found and where. Figure 3-2 is a typical report which is transmitted to the requesting Army or Air Force unit. In addition to the requesting unit, reports are also sent to a number of other reconnaissance/intelligence units for use as supporting collateral intelligence. Reports are communicated using both the tactical TARRRS system for Army recipients and AUTODIN for others.

The process just described is for requests for specific reconnaissance. In addition, the reconnaissance unit can also detect and report targets in areas not specifically requested. These "bonus" targets are often indications of new and previously unknown activities and will be more numerous with ABLE due to ABLE's increased capacity. It is anticipated that ABLE will allow requesters to enlarge their requested coverage areas substantially from the current 15 NM^2 "boxes."

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RHFRAAB RUFTFHA RUFTSHA.
 ZNR UUUXX

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 TO   RUFTTA/  TRW ZWEIBRUCKEN AB GE//ATTN WOC INTEL DESK//
      RXFKC/COMFOURATAF KINDSBACH COM GE//CID//
      RXSPKBA/COMAAFCE ER WIN//
      RUFLTAA/ATOC SEMBACH GE//
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 ITM001:32UPV47492762 CTY:GE 485859  11057E DTZ:092319
 A. 32UPV47492762
 B. 231925 SEP 80
 C.  POSS FIELD ASSEMBLY AREA. 20 VEHICLES LOCAT ED IN OPEN FIELD

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Figure 3-2 Reforger-80 Radar Reconnaissance Report

3.2 Typical Operating Scenarios

In this section, some typical reconnaissance operations scenarios are described in order to establish a framework for later capability descriptions.

3.2.1 Current Reconnaissance Operations Scenarios

SAR reconnaissance is presently conducted with a single aircraft flying a series of predefined tracks called "SLAR lines". After flying the predetermined lines, the aircraft returns to its base where the collected raw data is unloaded from the aircraft, processed into images and exploited. This method typically produces target reports within two to three hours after collection [time over target (TOT)]. Typical reconnaissance operations during major exercises have used several aircraft at approximately six hour intervals to provide coverage commensurate with both collection and exploitation capabilities.

Adding a data link to the aircraft allowed a reduction in report times to less than one hour by eliminating the return to base time. However, the manual exploitation capability began to be recognized as a limiting factor. This occurred because the RF-4 aircraft can collect imagery at approximately 4200 NM^2/hr and the manual exploitation systems can exploit only about 400 NM^2/hr per station. At the 26 TRW, the two station MARRES thus can handle 800 NM^2/hr. Fortunately aircraft on-station time limits the total collections to about 2000 NM^2 per sortie, thus the manual systems can keep up as long as missions are spaced several hours

apart. As a result, data link SAR missions are still flown several hours apart, but now result in rapid response reporting on predetermined target areas.

Recognizing the advantages of multiple source reconnaissance, the 26 TRW schedules a TEREC equipped aircraft 30 minutes ahead of the data link SAR aircraft. By doing this, TEREC intercepts can be used to immediately direct (cue) the SAR exploitation towards potential target areas.

3.2.2 Potential ABLE Operations Scenarios

The ABLE system's increased capacity and integral cuing capability allows it to overcome earlier problems identified with the data link implementation. Specifically, ABLE can exploit and report at the same rate as the UPD-4 equipped RF-4 can collect which allows new operations concepts to be tried, two of which are described here.

3.2.2.1 Continuous Coverage

ABLE allows continuous reconnaissance of an area as long as a data link equipped aircraft is airborne in the area. The 26 TRW demonstrated its ability to provide continuous aircraft coverage during REFORGER 1980 by using two aircraft and airborne refueling to keep one aircraft constantly imaging the exercise area. This operation was very successful as a countermeasure to the ground forces SAR Cover Concealment and Deception (CCD) technique of hiding during imaging.

3.2.2.2 Mission Retasking

Current operations are completely preplanned and only targets designated prior to the aircraft mission are imaged. ABLE can quickly adapt to exploiting new areas because of its automated reference imagery and collateral information data bases. Therefore, it is possible to change plans if potentially lucrative targets are identified during a mission.

An example will illustrate this concept. A mission is flown which is planned to image SLAR lines 1, 2 and 3 of a particular area. While imaging line 3, an image interpreter detects a large new concentration of returns near its edge. In order to properly assess this new threat, the analysts need to know what else is near by, so the aircraft commander is contacted by radio and asked to fly the adjacent line 4 instead of the scheduled line 2. This is done and the real-time imagery shows significant convoy activity, indicating an even larger buildup is possible at the original site.

Other instances for using retasking include the receipt of lucrative cues such as a TEREC intercept or telephonic reports of enemy sightings. With aircraft constantly available as is the case in a continuous imaging operation, it is easy to capitalize on these real-time inputs and requests by redirecting the aircraft.

The key to this capability is the ability of ABLE to easily adapt to new areas and to report imagery interpretation results in real-time. It is also important to realize that using ABLE allows complete utilization of the full collection capabilities of the RF-4, making more cost-effective use of expensive flying hours and creating new operational challenges for flight operations personnel.

4.0 SYSTEM DESCRIPTION

This section presents an overview of the ABLE system components. The intent is to familiarize the reader with the major components whose operational descriptions follow in Section 5.0.

4.1 System Description

This section describes the major functional components of ABLE at the shelter level. It then provides a brief overview of the major system signal flow.

4.1.1 Major Functional Components

The major components of the ABLE system are depicted in Figure 1-1. The functions of each component are:

Radar: The airborne radar (APD-10 or APD-11) provides image phase histories of terrain and targets to either side of the RF-4. These phase histories are transmitted to the ground via a data link.

QRC Shelter 1: The data link signal containing the raw radar return signals (phase histories) is received by equipment in Shelter 1, and provided to ABLE.

SAPPHIRE: SAPPHIRE is a digital signal processor which produces digital images from the radar phase histories.

Automatic Change Detector (ACD): The ACD automatically compares the real-time image from SAPPHIRE (called the mission image) with a previously stored reference image and reports to the ES significant clusters as probable targets for further investigation.

Exploitation Subsystem (ES): The ES contains display stations for viewing and interpreting the images in order to detect and report targets.

Exploitation Management Cell (EMC): The EMC provides exploitation support data such as collateral reports, previous target reports, digital maps and other collection source cues.

4.1.2 Signal Flows

The major ABLE signal flows are depicted in Figure 4-1. The signal flow from left to right in the illustration goes from the raw data link signal into Shelter 1 to the final exploitation report out of the EMC. The following describes each of the major signals block by block.

The input to Shelter 1 is the data link signal received from the airborne radar. Shelter 1 controls the tracking antenna, receives the data link signal, demodulates it, and furnishes the demodulated radar phase history signal to SAPPHIRE. Shelter 1 also demodulates and furnishes the APD-10 auxiliary data signal to SAPPHIRE.

SAPPHIRE receives the raw radar phase history from Shelter 1 and performs the necessary digital correlation to generate digital imagery. The digital imagery is furnished in three different output ports with two formats. Channel A is nominal 10 foot pixel spacing imagery in an 8-bit logarithm encoded format and is intended for detailed exploitation. Channel B is nominal 20 foot pixel spacing imagery in an 11-bit floating point format intended for screening/automatic change detection. Channels A and B are connected to the ACDS. The direct mode imagery port is

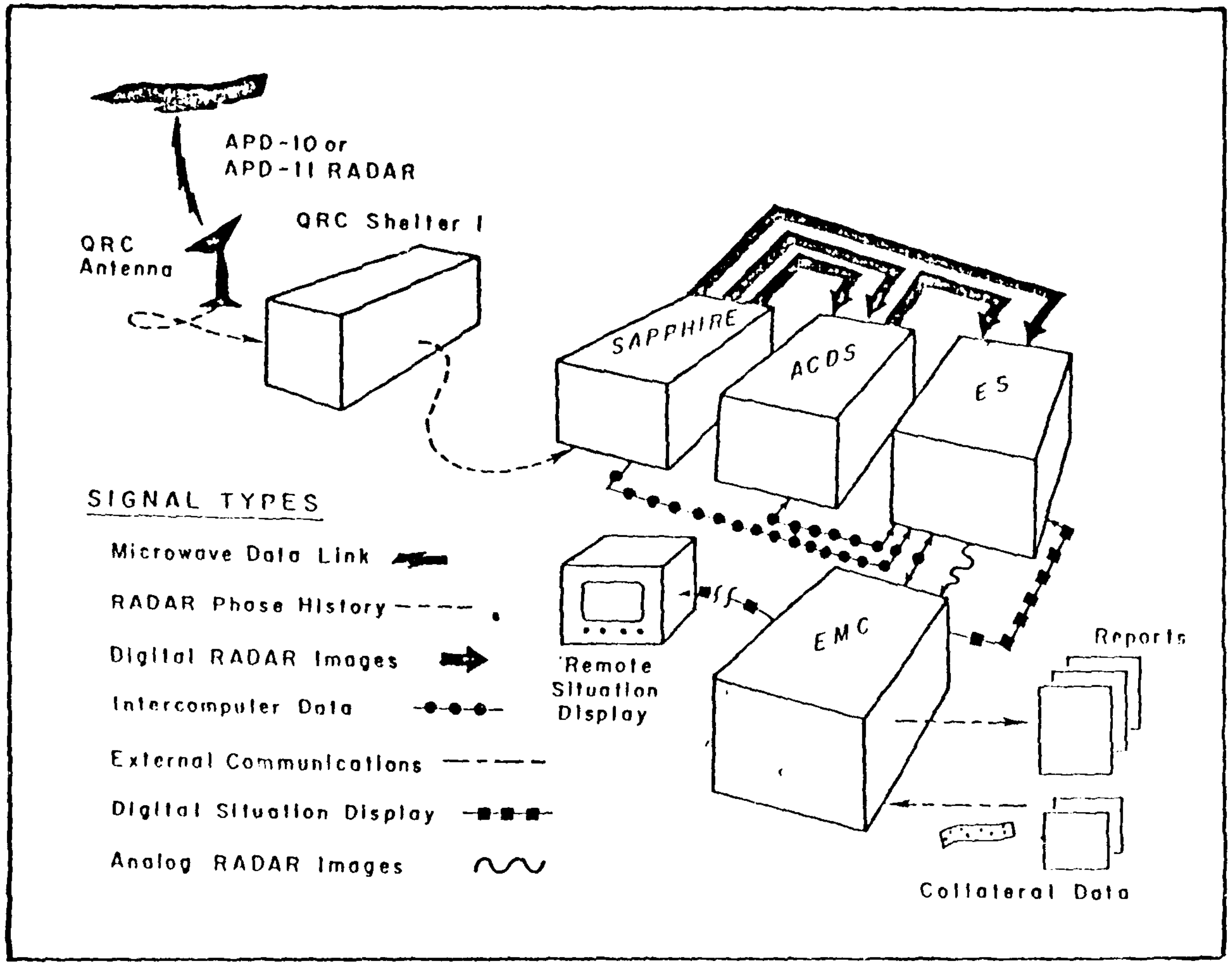


Figure 4-1 ABLE Major Data Flows

connected to the ES and provides the same image as channel A. This provides an alternate image path for exploitation if the ACDS is not available. SAPPHIRE also decodes the APD-10 auxiliary data (Aux data) and distributes it as low speed data (ADAS) to the ES and EMC.

The ACDS receives the 10 foot A channel data, stores it and then passes it on to the ES when requested. This buffering is usually for a short period of time (less than 60 seconds) and provides synchronization with the change detections being developed from the channel B imagery. However, the entire image is saved for later recall if necessary. Similar to channel A, channel B imagery is received, stored and furnished to the ES on request. In addition, the 20 foot imagery is aligned with a previously stored reference image (perhaps the last radar image of this area) and significant differences are noted. These change indications, along with the aligned mission and reference images are transmitted to the ES. The ES and ACDS also exchange control and status information through a direct computer link.

The ES receives imagery either from the ACDS (mission and reference) or from SAPPHIRE in the direct mode. The direct mode provides a reduced capability system if the ACDS should not be functioning. The ES also receives interpreter aids in the form of cues and maps from the EMC and change cues from the ACDS. All of this information is made available to the image interpreters who develop reconnaissance reports. These reports are then transmitted to the EMC. The ES and EMC also exchange control and status information using a direct computer-to-computer link.

The EMC receives target reports from the ES and transmits these to outside users using tactical message channels. The EMC also receives reports and information from other reconnaissance/intelligence sources for use as interpreter cues. In addition, the EMC receives the APD-10 auxiliary data for use in maintaining a situation map.

The above description of the major signal flows is intended to be a functional overview. There are additional control and status signals, as well as inter-shelter communications that are not described here. More details of the signal flow may be found in the ABLE interface specifications.

4.2 Physical Layout

The ABLE system will be located at Zweibrucken AB, FRG which is the location of the 26th Tactical Reconnaissance Wing (TRW) and the 38th Tactical Reconnaissance Squadron (TRS). Figure 4-2 shows the location of the system on the base adjacent to the semi-hardened Precision Photographic Interpretation Facility (PPIF) which houses the majority of the squadron exploitation equipment. Figure 4-2 also shows the expected placement of each ABLE shelter on the concrete pad.

4.3 SAPPHIRE

SAPPHIRE is a high speed digital signal processor which processes the radar phase history signals from the data link into a digital image.

The SAPPHIRE processor is capable of processing UPD-4 and UPD-6 radar to full resolution and swath width at real-time collection rates. SAPPHIRE operates in a variety of modes which depend upon the type of preand post-detection signal processing.

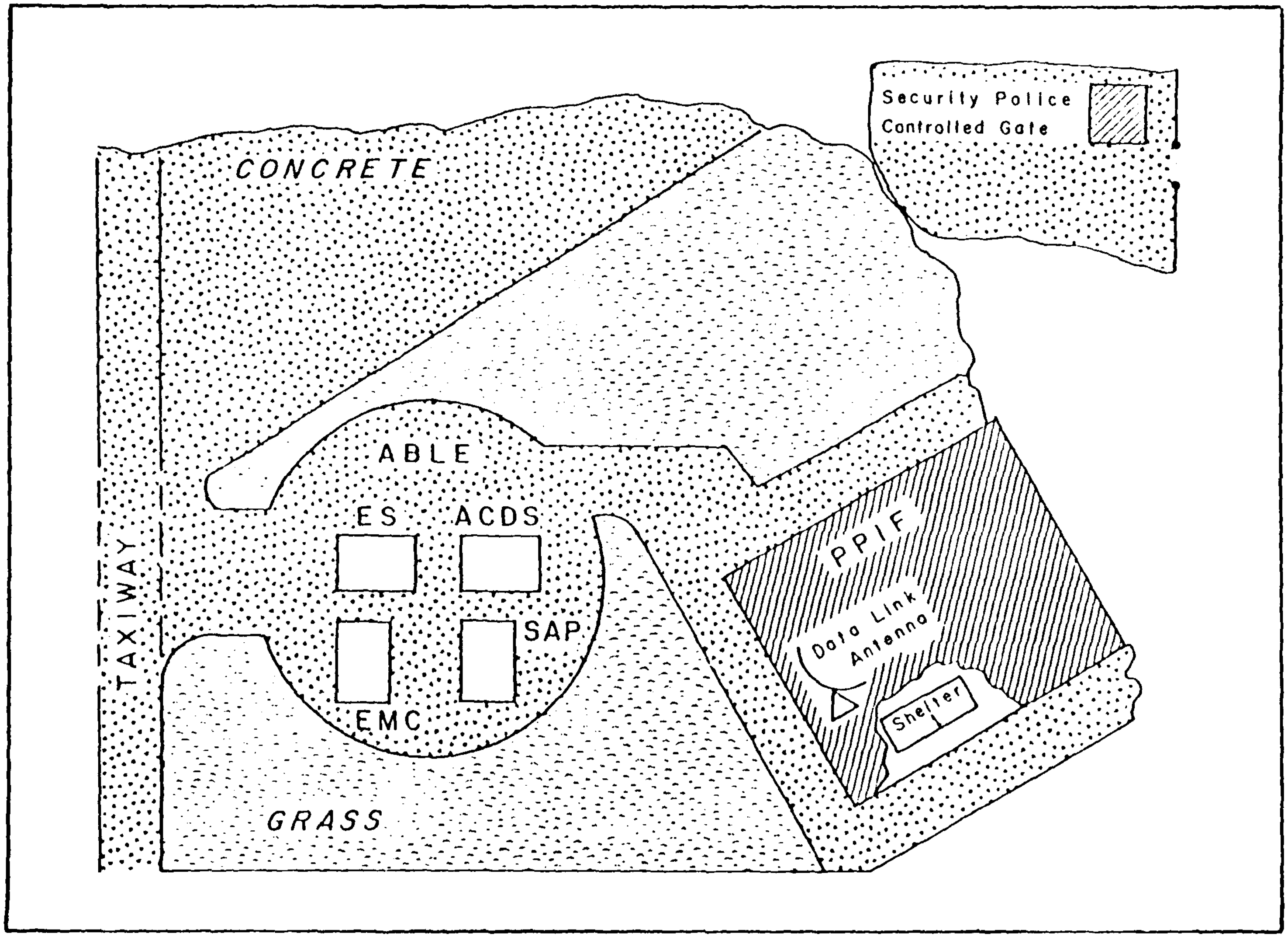


Figure 4-2 Shelter Layout at Zweibrucken AB

In addition to pre- and post-detection image processing, SAPPHIRE also features both manual and automatic focusing and slant-to-ground range conversion.

ABLE will operate with SAPPHIRE in mode A1B2 for 10 foot detail analysis imagery and D4A1 20 foot imagery for change detection. Both types of imagery will be output simultaneously through parallel output ports. Image output will be in the ground plane at a rate of approximately 0.54 megapixels per second for 10 foot data and 0.135 megapixels per second for 20 foot data.

The interior of the SAPPHIRE shelter is shown in Figure 4-3 . The front half of the shelter contains operator interfaces while the back half contains the digital processor.

Located at the operator's console are controls for SAPPHIRE operating parameters, an oscilloscope for monitoring input signal levels, an output image display for monitoring image quality, a computer terminal (CRT) for monitoring aircraft auxiliary data, and tape recorder controls.

Near the operator console is the phase history tape recorder and the image tape recorder. These two tape recorders allow the SAPPHIRE operator to record and play back data/imagery before or after SAPPHIRE processing. This is an important feature since it provides the ABLE system the capability to:

- Replay images anytime after the aircraft has collected them (non-real time).

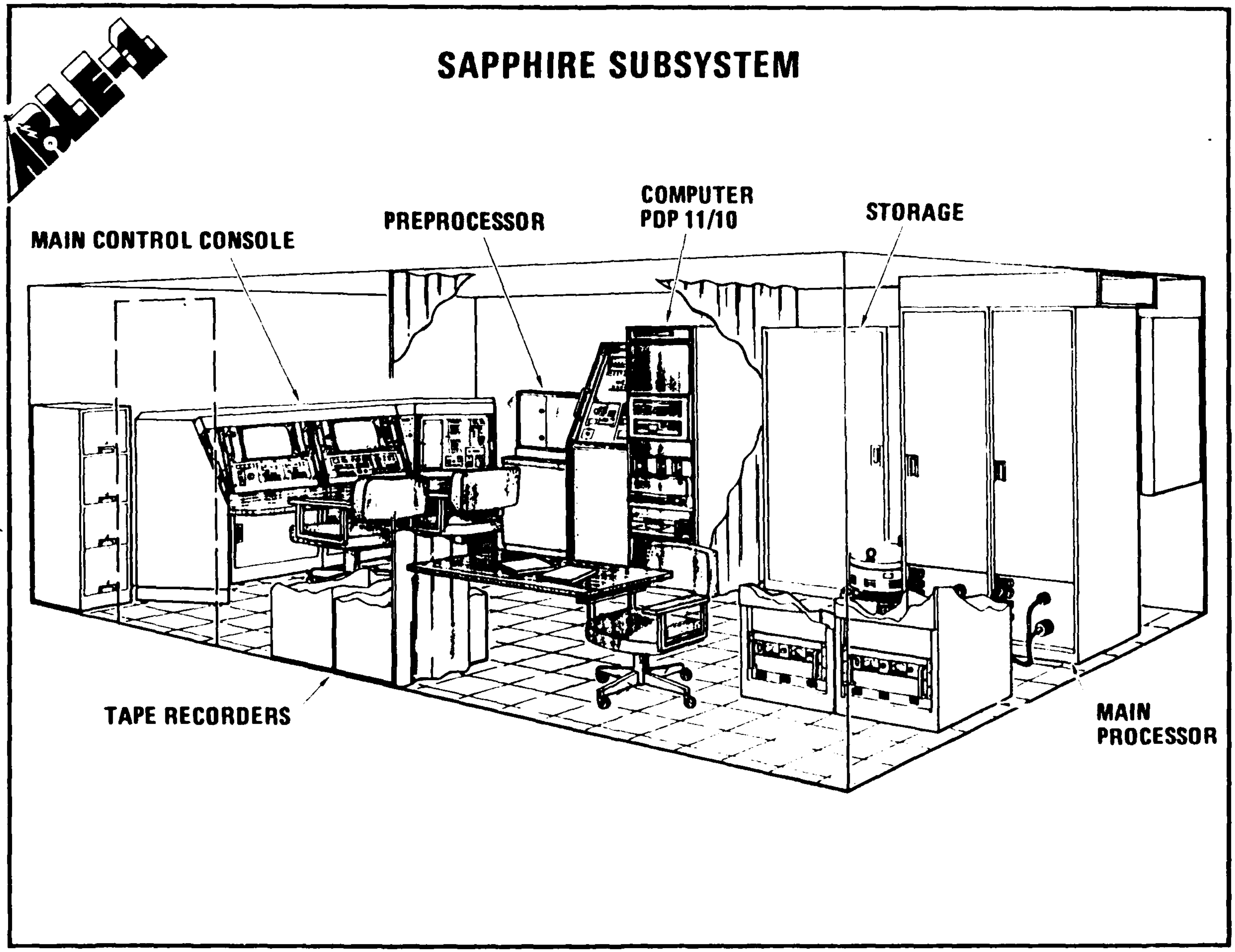


Figure 4-3 Interior View of SAPPHIRE

- Train personnel without using an aircraft.
- Create new reference imagery in ES ACDS.
- Have a backup in case of inability to exploit in real time.

4.4 Automatic Change Detector Subsystem (ACDS)

The ACDS is shown in Figure 4-4 and provides ABLE the following capabilities:

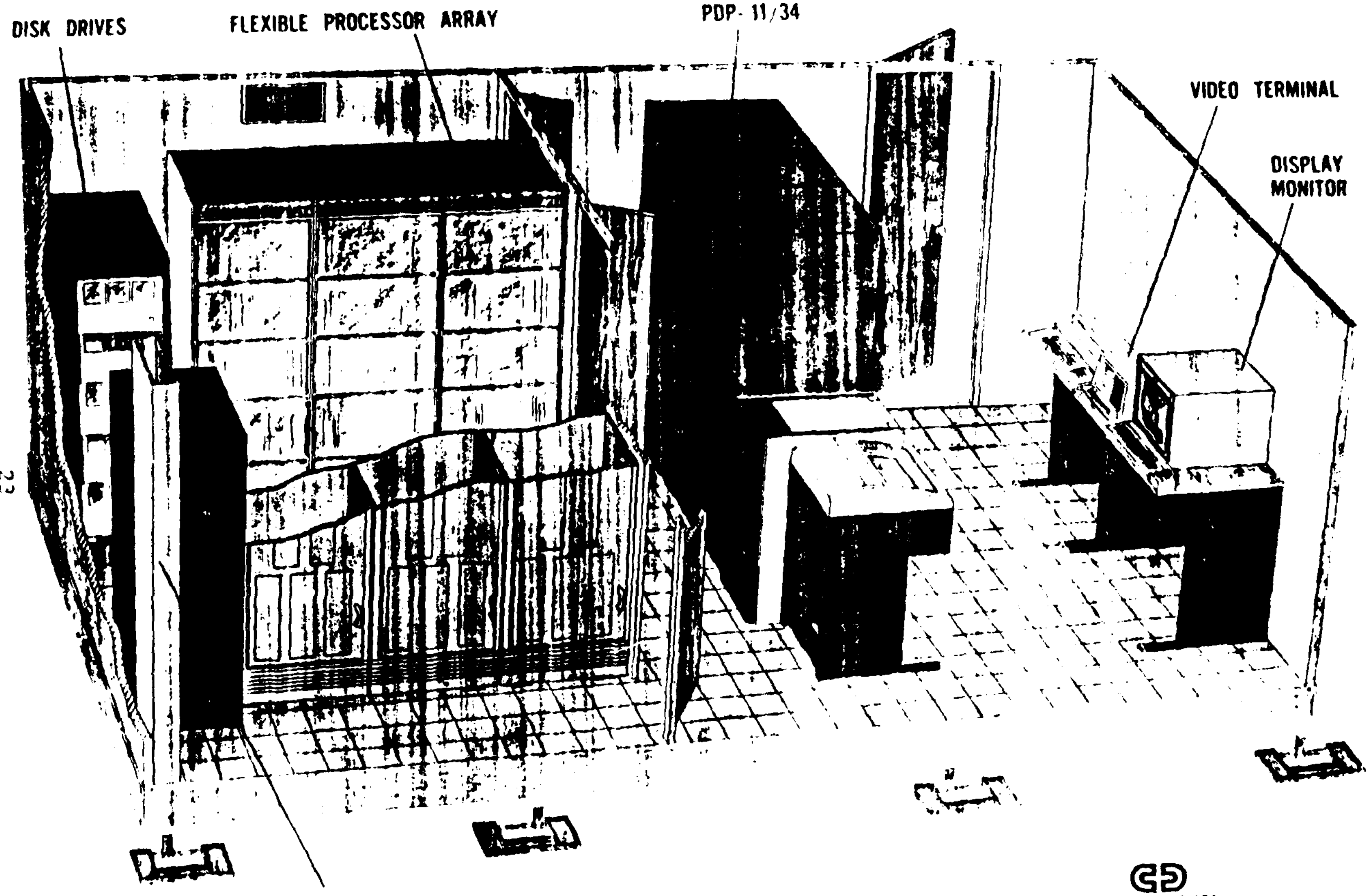
- Reference image storage.
- Buffering of imagery to allow varying of presentation rate.
- Automatic registration/alignment of the mission and reference imagery to an accuracy of approximately 20 ft.
- Automatic change detection.
- Automatic reference image updating.

The ACDS provides the primary operational storage for ABLE imagery. The ACDS maintains approximately 1500 NM^2 of 20 foot reference imagery on its data base disks while maintaining up to 500 NM^2 at 10 foot mission imagery. The reference imagery is broken up into several individually recallable SLAR lines and the mission imagery can easily be converted to a new reference image.

The ACDS performs change detection by detecting significant differences in intensity between mission and reference images on a pixel-by-pixel basis. The ACDS further processes the raw changes for clusters of changes. The number of changes to a cluster as well as the difference threshold are key operator selectable parameters. When a

ABLE-1

AUTOMATIC CHANGE DETECTION SYSTEM



CONTROL DATA CORPORATION

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Figure 4-4 Interior View of ACDS

significant size cluster is detected, the ACDS signals the exploitation system that a potential target exists and cues its location on the mission image.

Working on a pixel-by-pixel basis requires a very high precision in registration (alignment) of the mission and reference images. This is done by a quadratic warping of the reference image based upon the dynamic outputs of a 6-degree Kalman filter. Performing these functions in real time with input data rates of approximately 2 MBS requires a large buffer (240 mbytes) and a high processor rate. This processing rate is achieved through the use of a distributed multi-microprocessor system using 22 CDC flexible processors.

4.5 Exploitation Subsystem (ES)

The heart of the ABLE is the exploitation subsystem (ES) which is illustrated in Figure 4-5. The ES contains softcopy image displays and analyst support tools to support the real-time two-stage interpretation of SAR imagery and generation of target reports.

The illustration shows six display stations (called Software Reconfigurable Display - SRD) and an exploitation controller (EC) station. The SRD is an interactive softcopy image display station and is described later. The other major ES components are the control computer, the image buffer and the EC situation display.

When operating, the ES is typically configured so that four of the stations are screening and two are detail analysts. Screening stations display one-fourth (2.5 miles) of the alternating mission and reference

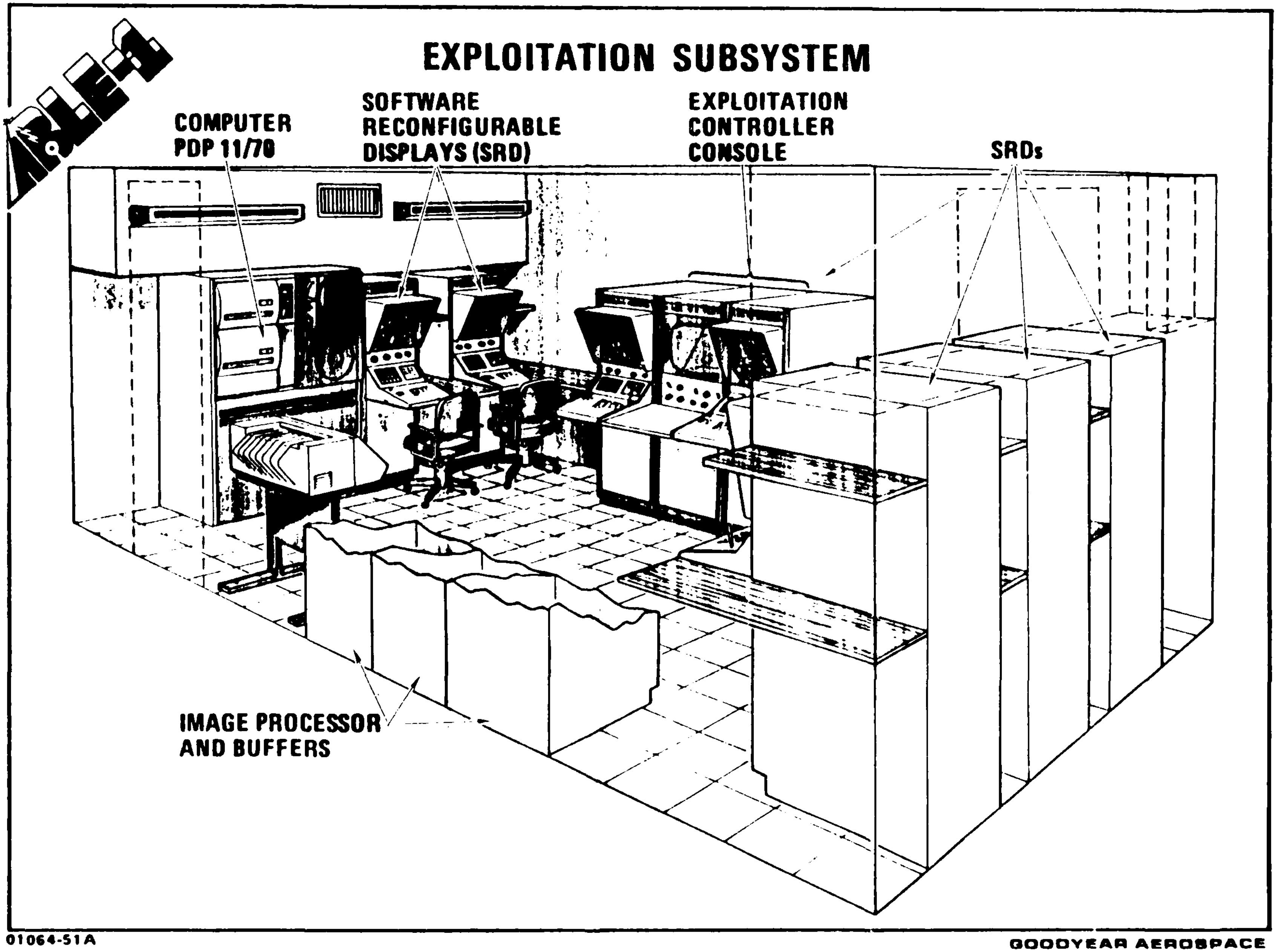

Figure 4-5 Interior View of ES

images which are moving down the display at a selectable rate. The image scroll rate may vary from an equivalent ground speed of zero up to 1200 feet per second. During operations, relevant collateral information (cues) are displayed as symbols on the scrolling imagery. Change area cues from the ACDS are also displayed as circles around the change area. The scrolling imagery is viewed by an image interpreter who functions as a screener. As targets are detected on the scrolling imagery, the screener directs the system to transfer a copy of the image with the target to a temporary storage. High priority images may be designated to be placed at the front of the buffer storage. Image interpreters at the detail stations then request that images from this buffer be displayed on a scene-by-scene basis for detailed analysis and reporting.

The EC console performs specialized EC functions and has the additional feature of a 19-inch color situation display which can display selectable maps and other pertinent information. The EC console also permits control of the system configuration, allowing the EC to select the mix of screening and detailing stations.

The selection of four screening and two detailing stations is arbitrary since an SRD may be easily configured by the EC to be either a screener or detailer. This feature of ABLE allows full flexibility in workload assignment, and permits taking advantage of the ACDS potential to allow screeners to handle wider areas. This also permits assigning up to all 6 image interpreters to detailing in order to work at backlogs during nonimaging periods.

The Software Reconfigurable Display (SRD) (Figure 4-6) contains a high resolution 17-inch image display, a keyboard, a combination situation display/alphanumeric CRT and a small CRT serving as a function switch called a Programmable Switch Assembly (PSA). Touching the PSA in one of 28 spots activates the function displayed on the CRT (Figure 4-7). Since any two-line, 8-character legend may be displayed on each of the 28 PSA locations, the PSA provides an unlimited flexibility for function keys. In the ES, this capability is exploited to a very high degree so that actual typing is minimized and operator training is simplified.

The SRD alphanumeric display can either be a small map display which is a copy of the EC larger situation display or it may be an alphanumeric display showing reports and other interactive information. The choice is an individual operator decision.

4.6 Exploitation Management Cell (EMC)

The Exploitation Management Cell (EMC) depicted in Figure 4-8 contains a command and control console, a control computer and map digitizing equipment.

The command and control console consists of a 4-foot screen with a rear projection color display and three computer consoles which are SRD's without image displays. The projection system is used for display of maps and situation overlays which are contained in the EMC data base.

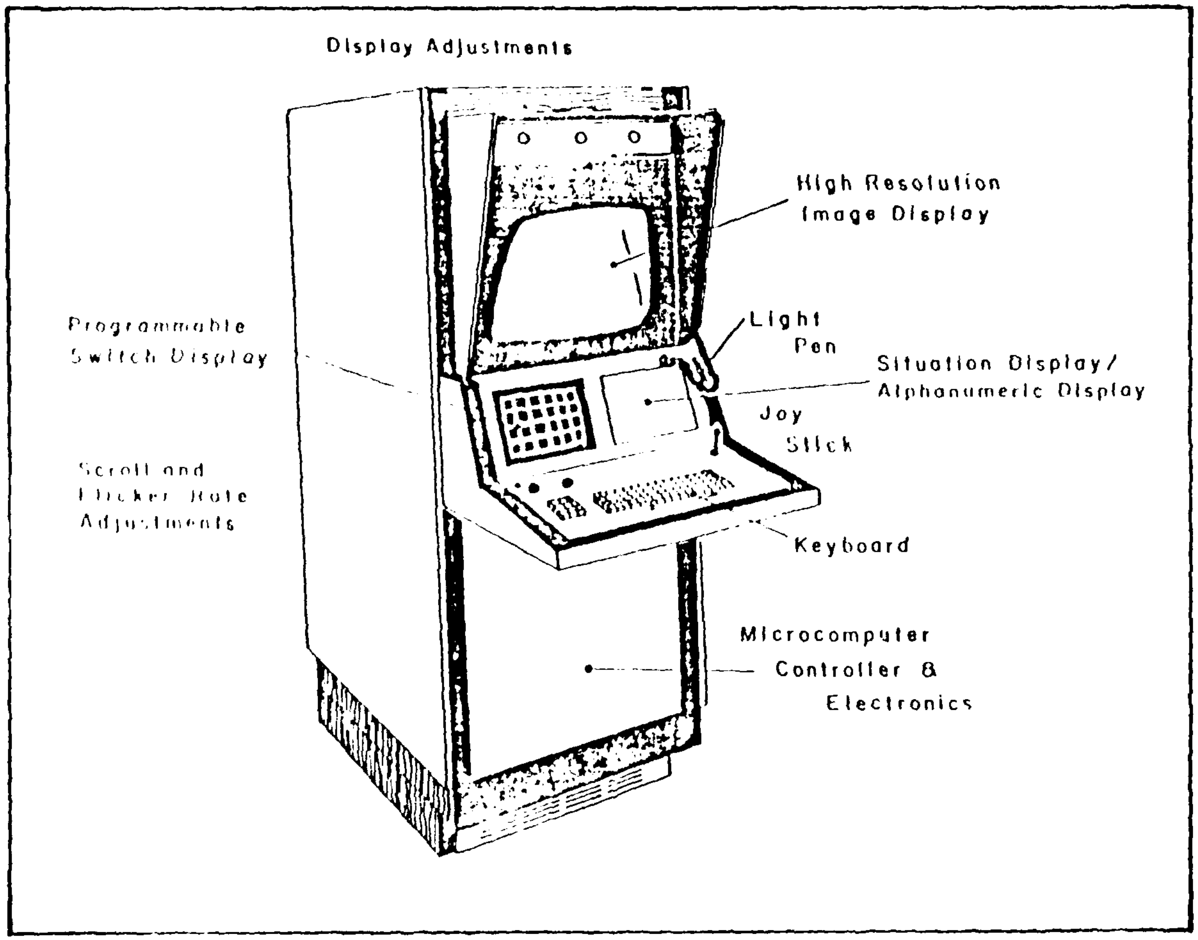

Figure 4-6 Image Interpreter Display Station (SRD)

EXPLOIT						
NEXT SCENE		ARCHIVE SCENE	TARGET DETECT	TURN PAGE	PRINT IMG/RPT	XMIT
CRSHAIR LOCATION	COORD DRIVE	DISTANCE	COORD CONVERT	VIEW CUES	VIEW REPORTS	PHRASE ENTRY
	FLICKER ON/OFF	MISSION REFERENCES	SYMBOLS ON/OFF	PAGE FORWARD	PAGE BACK	MOVE REFERENCE

Figure 4-7 Typical PSA Legends

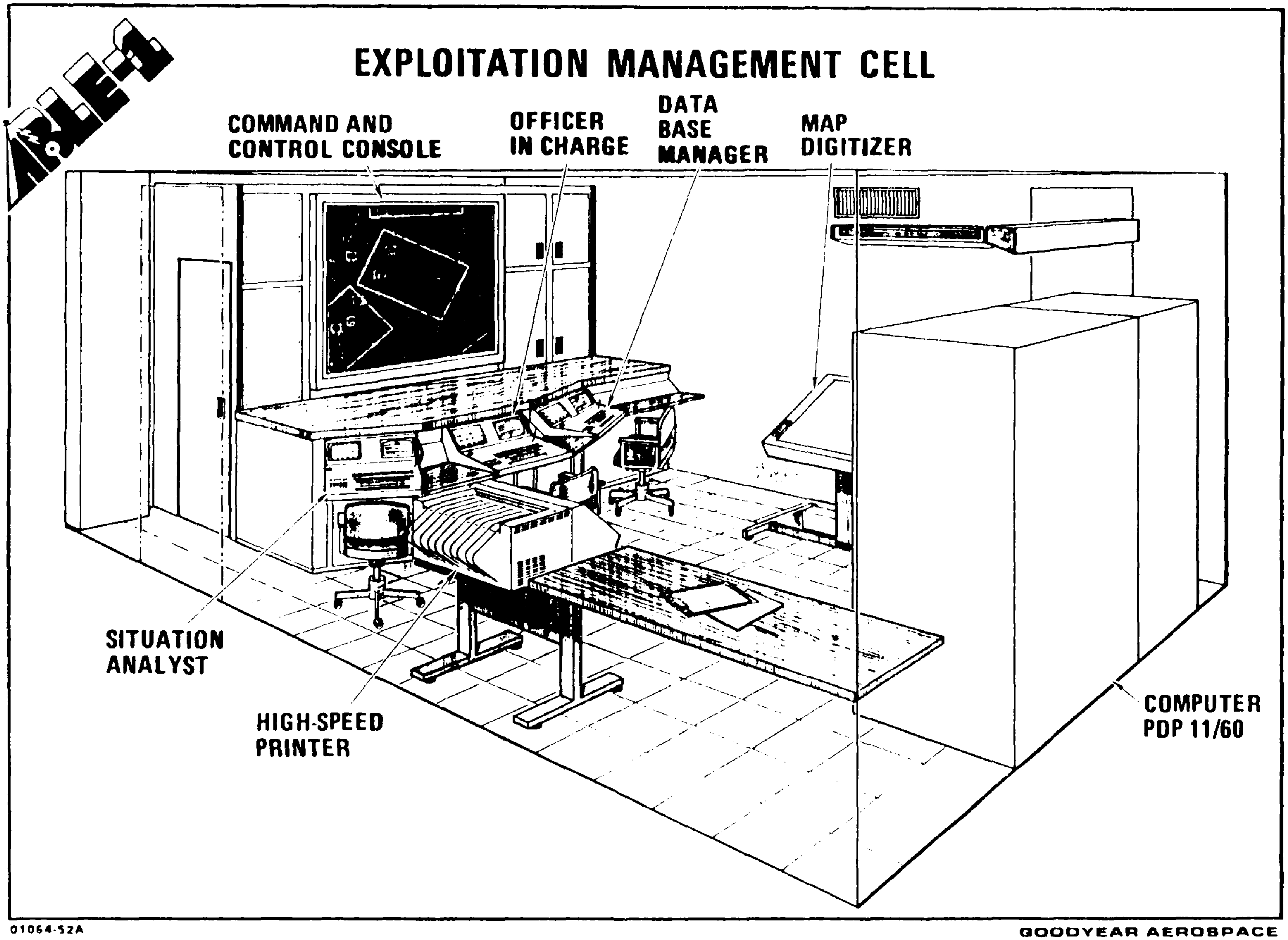

Figure 4-8 Interior View of the EMC

The three consoles each contain a PSA, an alphanumeric display, a joystick and a keyboard and are connected to the EMC computer to permit control of the ABLE-EMC system. The EMC display may also be viewed at a remotely located monitor connected by a 1/4 mile fiber optic cable. This monitor will be located in the 38th TRS operations area.

The EMC computer supports the Collateral Information Data Base (CIDB) which contains data to aid in interpretation. The computer also supports preparing and storing of digital maps and external communicating of reports and cues.

The EMC contains a large digitizing tablet for tracing maps, charts, interpretation keys or any other graphic material for storage and display. The digitizing capability combined with a 35 mm slide projector built into the situation display optical path provides ABLE with a versatile briefing and training aid as well as useful interpreter aids.

5.0 ABLE SYSTEM OPERATIONS

The purpose of this section is to describe typical ABLE operations that will occur in support of the mission scenarios described in Section 2.0. This section is organized to present:

- A possible ABLE personnel structure
- Basic system operating modes
- Subsystem operations descriptions

5.1 Personnel

A suggested personnel structure is shown in Figure 5-1. Local policies and user preferences will determine the actual structure. The suggested structure reflects the assignment of responsibilities for maintenance to contractors and for operations to military personnel. Duties and responsibilities of each person are described in following sections. The parentheses indicate where the person is located during missions.

5.1.1 ABLE Officer in Charge (EMC)

The Officer in Charge (OIC) is responsible for accomplishing the ABLE mission through management of the assigned equipment and personnel resources.

5.1.2 ABLE NCOIC (EMC)

The Non-Commissioned Officer in Charge (NCOIC) is responsible for assisting the OIC and for supervising assigned military personnel.

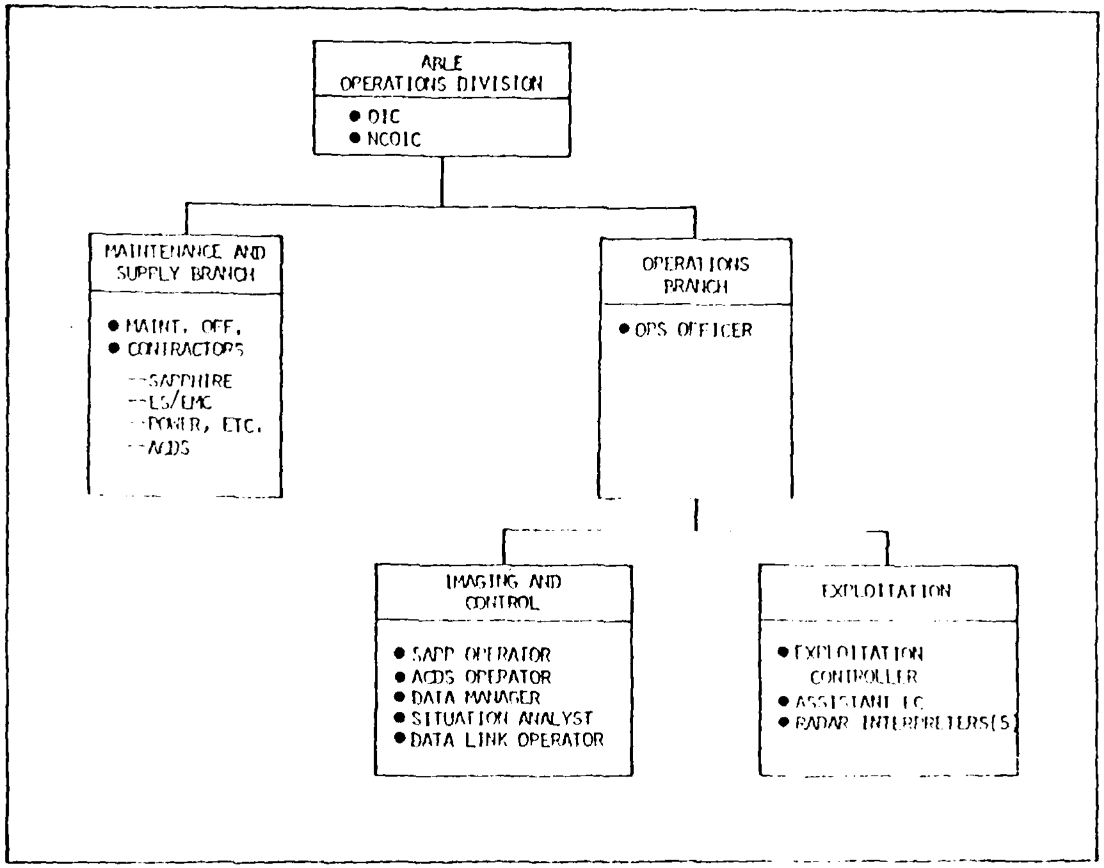

Figure 5-1 Personnel Organization for ABLE Operations

5.1.3 Maintenance Officer

The Maintenance Officer is responsible for maintaining the operational status of all assigned equipment, including required maintenance reporting and supply operations.

5.1.4 Operations Officer (EMC)

The Operations Officer is an image interpreter responsible for ABLE system operations. This function could be combined with the duties of the ABLE NCOIC.

5.1.5 SAPPHIRE Operator (SAP)

The SAPPHIRE Operator is responsible for operating the SAPPHIRE system.

5.1.6 ACDS Operator (ACDS)

The ACDS Operator is responsible for operating the ACD system.

5.1.7 Data Base Manager (EMC)

The Data Base Manager (DBM) is an intelligence analyst and is responsible for managing the EMC Collateral Information Data Base and operating the EMC computer.

5.1.8 Situation Analyst (EMC)

The Situation Analyst is an intelligence analyst and is responsible for developing situation overlays for EMC maps and assisting in CIDB maintenance.

5.1.9 Exploitation Controller (ES)

The Exploitation Controller (EC) is a senior image interpreter and is responsible for supervising ES personnel and controlling Imagery Exploitation.

5.1.10 Assistant Exploitation Controller (ES)

The Assistant EC is an image interpreter with additional responsibilities assisting the EC.

5.1.11 Image Interpreters (ES)

Image Interpreters (II) operate SRD's in the ES and are responsible for interpreting imagery. They perform the screening and detailing functions.

5.1.12 Contract Maintenance (All Shelters)

All maintenance except for operator checks is the responsibility of the system development contractors.

5.2 Basic Operating Modes

Describing ABLE operations is simplified if the operating time is divided according to what is being done. In this description, these operating time divisions are called operating modes and are shown in Figure 5-2. The modes are related to aircraft operations and mode changes occur when the events shown on the arrows occur. The non-mission

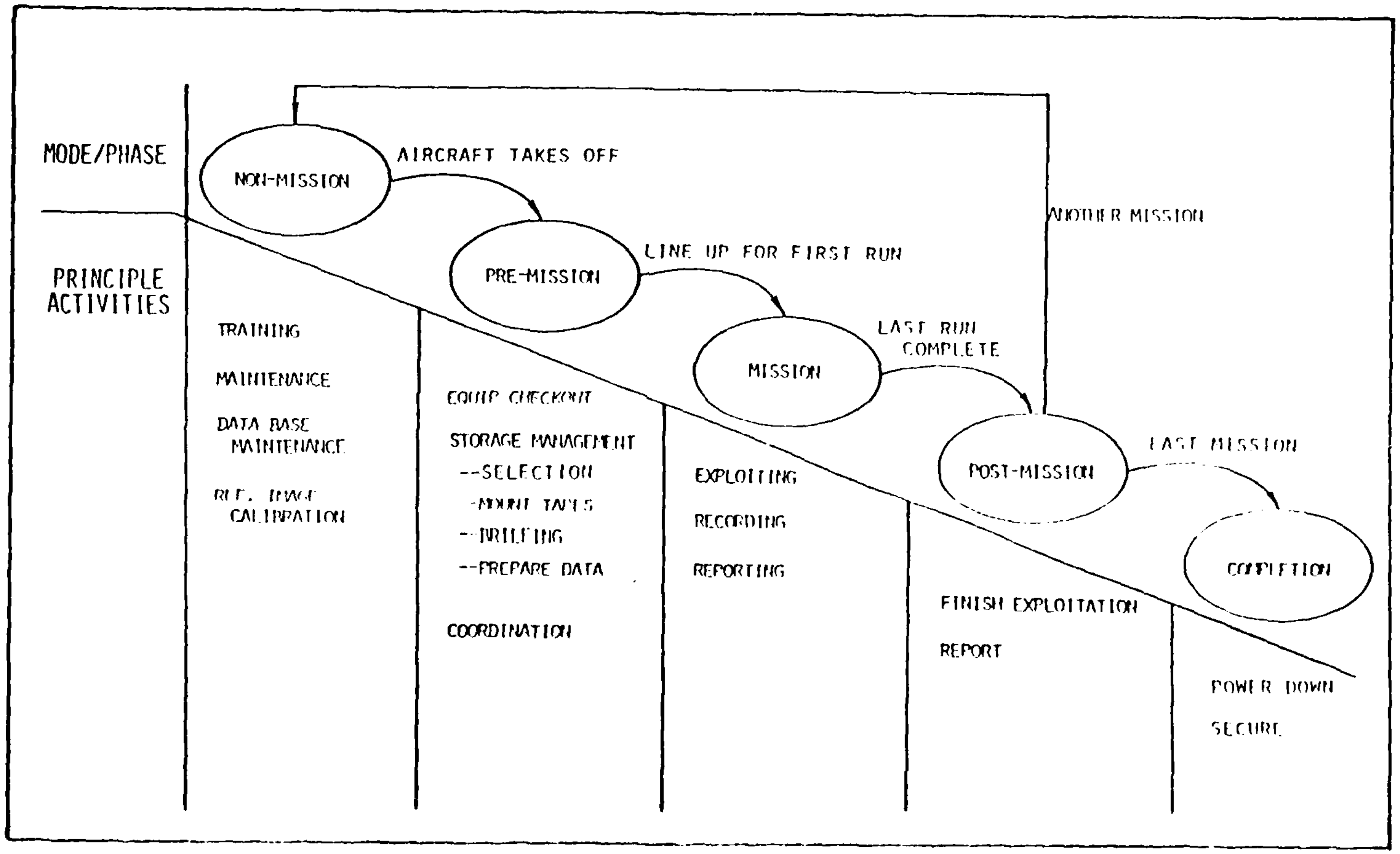

Figure 5-2 ABLE Operating Modes

mode is the usual mode and represents the times when no data link equipped aircraft are scheduled to fly. The pre-mission mode begins shortly before the imaging aircraft (or the first of a multi-sortie mission) takes off. When the SLAR aircraft (or the first of a multi-sortie mission) begins the first imaging run, the mission mode begins and continues until the last SLAR line is flown and the last aircraft begins to return to base. Then post-mission mode activity begins, and continues until completion and a return to non-mission mode. Each of these modes is described in more detail in the following sections.

5.2.1 Non-Mission Mode

The non-mission mode activities are intended to ensure the readiness of the system for mission operations. Typical of these activities are:

- Corrective Equipment Maintenance.
- Data Base Maintenance.
- Training.
- Preventive Maintenance.
- Administrative Support Functions.

5.2.2 Pre-Mission Activities

Pre-mission activities are to prepare for exploiting specific SLAR lines. These activities consist of understanding the mission requirements, selecting the appropriate reference images and collateral

data, and preparing all equipment. In cases where there is a real-time change to mission plans, such as a dynamic retasking, mission activity may be terminated and new pre-mission activities begun.

5.2.3 Mission Activities

Mission activities are centered on exploiting real-time imagery. Mission activity flow is shown in Figure 5-3 and is described in the paragraphs which follow.

First, a decision is made by the EC as to whether any exploitable imagery will be obtained from the aircraft through the data link and into/through SAPPHIRE. This could be done by imaging a test target array after the aircraft has reached its altitude and the data link signal has been acquired. After this initial test, checks of reference imagery, collateral data and maps are made to be sure the right information is loaded. Then it is necessary to wait until the aircraft reaches the mission area and the beginning of a SLAR run. The situation display shows graphically where the aircraft is, and during the time the aircraft is lining up for the SLAR run the EC has the opportunity to view the mission image and verify that the correct reference image has been selected. When the run begins, the mission and reference imagery are registered and imagery screening begins. Typically, four II will screen while two perform detail analysis. Selected imagery is then analyzed to generate target reports. When screening is completed, the screeners can do detail analysis (if any scenes remain unexploited) until all imagery is exploited and the exploitation system is ready for another run. When

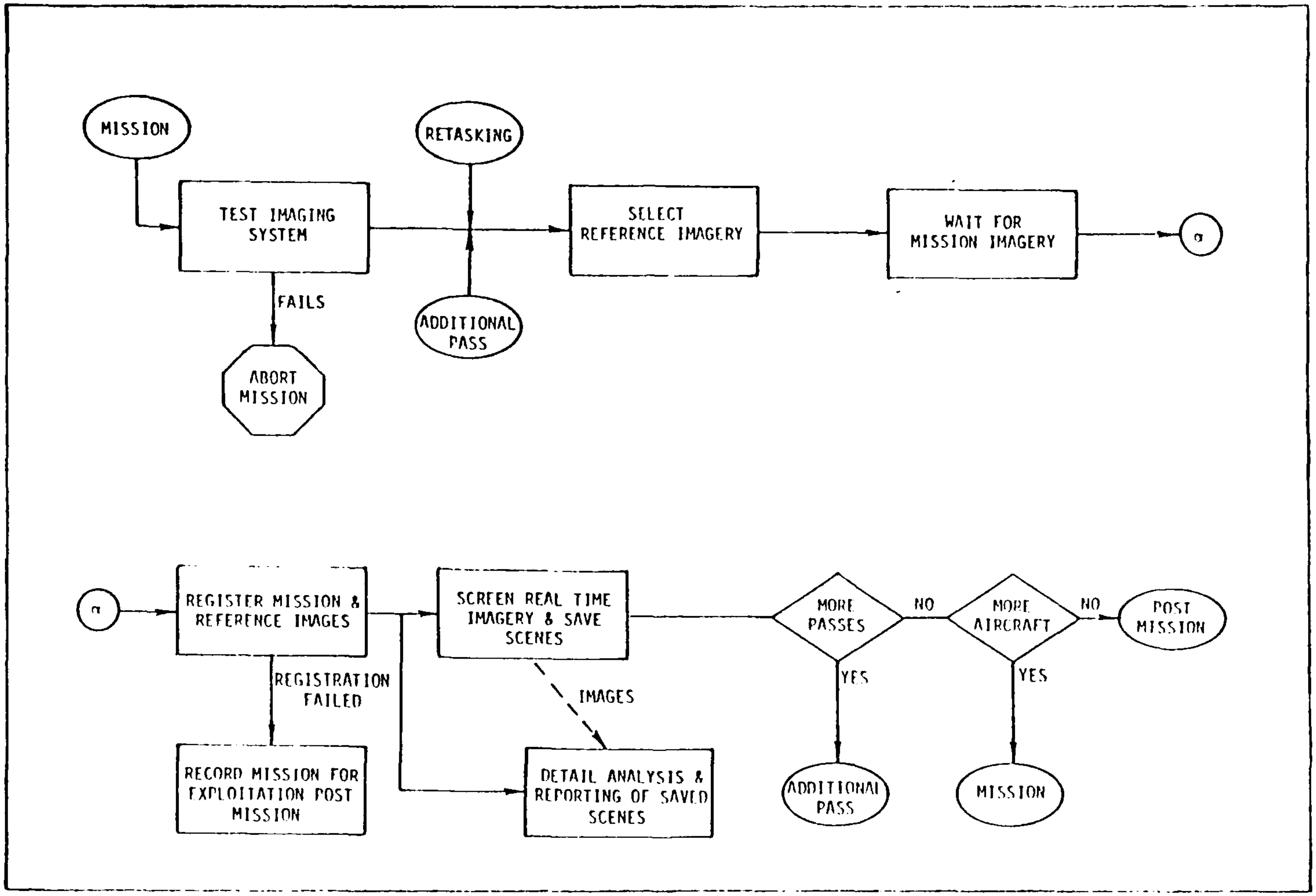

Figure 5-3 Flow of Exploitation Operations

a run is completed, the system is prepared for the next line of the current aircraft or the next aircraft of a multi-sortie mission. When the last line of the last sortie is completed, then the system can return to the non-mission mode.

When tasking changes during a mission, the activities begin as though a new SLAR line is being exploited.

5.2.4 Post-Mission

Post-mission activities include exploiting or re-exploiting any runs which were recorded during the mission mode. Post-mission activities also include saving and logging new imagery (tapes and disks), preparing reports, making maintenance requests and mission debriefing.

5.3 EMC Operations

The Exploitation Management Cell provides exploitation aids and supports management of the system. Exploitation aiding is accomplished by obtaining, storing, filtering and furnishing information to the ES which tells the interpreter:

- Where to look.
- What types of equipment/activity might be found there.
- The battlefield situation in the area.
- What has been previously reported by ABLE and other systems.

System management is provided primarily by the presence of the OIC/NCOIC and management support tools such as the intercom, telephone, administrative data bases and briefing aids.

Major EMC functions are largely independent of active missions and continue during a mission. The major EMC functions consist of:

- Cue management.
- Map generation.
- Situation display management.
- Administrative file maintenance.
- Maintenance, training, and demonstrations.

Each of these, except maintenance and training, will be described in the following paragraphs.

5.3.1 <u>Cue Management</u>

The EMC computer supports the maintenance of a large data base containing collateral information that includes items such as previous ABLE reports and other sensor reports. This Collateral Information Data Base (CIDB) is the basis from which exploitation aids called "cues" are developed. In addition, the CIDB allows the image interpreter to retrieve all available information about a particular target as an aid to improving target identifications. In the following paragraphs, cues, cue sources and cue development are further described.

5.3.1.1 <u>Definition of a Cue</u>. A cue is information which assists the interpreter by directing the search to particular areas. Cues also provide collateral information which assists the interpreter in determining what is at a particular location. Examples of cues are ELINT

[illegible]

- [illegible]
- [illegible]
- [illegible]
- [illegible]

[illegible] for exploitation. [illegible] is a cue source. The [illegible] TIPI-A, the telephone, and [illegible] media provide access to [illegible] medium indicated in brackets :

- 26 TRW External Sources :
  1. USAFE Combat Operations Intelligence Center [illegible] Autodin).
  2. AAFCE Tactical Fusion Center (TFC) (via Autodin).
  3. VII Corps All Source Intelligence Center (ASIC) (via TARRS).
  4. U.S. Army Quick Look Reports (via TARRS).
  5. U.S. Army Mohawk SLAR Reports (TARRS).
  6. U.S. Army ARL2 Sitreps (TARRS).
  7. Selected Radar Activity (SRA) Reports (Autodin).

[illegible] Reports (Autodin).

[illegible] Reports (TARRS).

[illegible] Air Controller Summaries (FACSUM) (Autodin).

[illegible]

[illegible]

[illegible] (telephone & HF radio [illegible]).

[illegible]

[illegible] [illegible]-outlined.

[illegible] [illegible], FTP, etc. [illegible].

[illegible] Reports.

[illegible]. The process of screening [illegible] is illustrated in Figure [illegible]-4. [illegible], the [illegible] has three different but interrelated filters [illegible] described below.

The [illegible] filter [illegible] input filter which determines whether the [illegible]. Examples of source data [illegible] (MTI) data more [illegible] battlefield [illegible] filter which is [illegible]. Except in a few cases [illegible] installation [illegible], experience

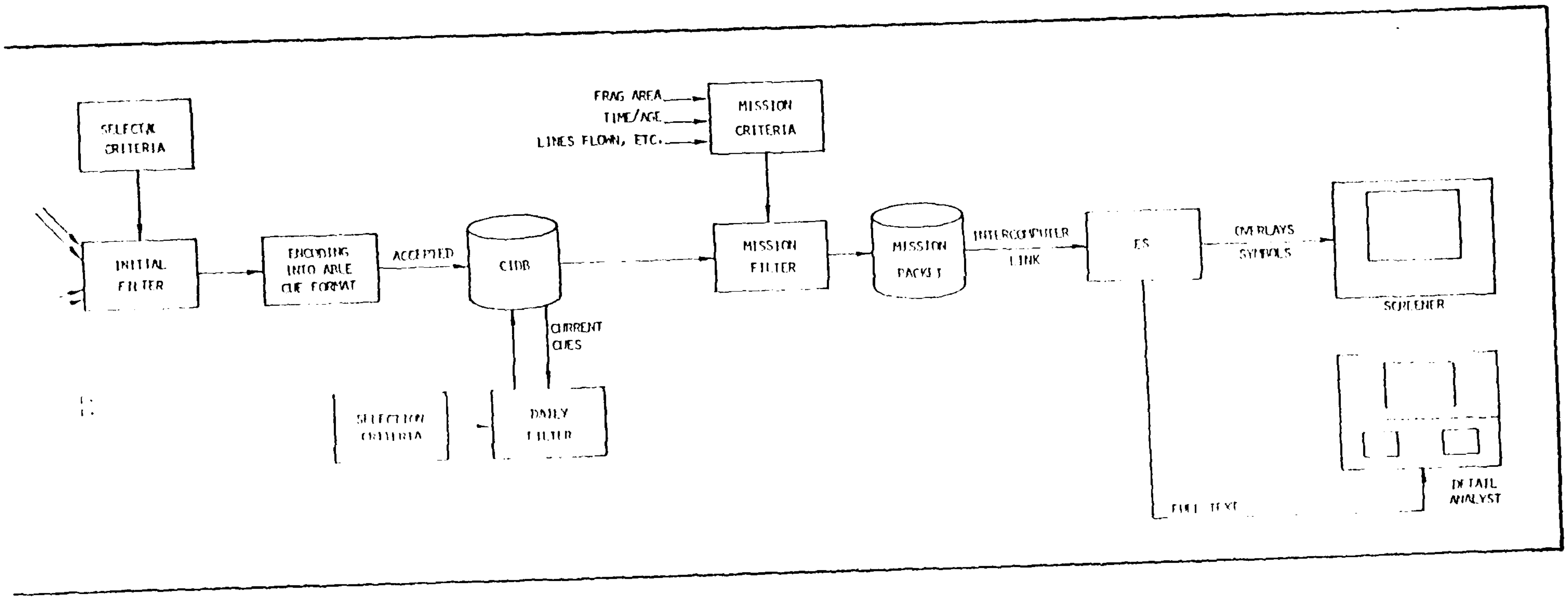

Figure 5-4 Cue Filtering Flow Chart

has shown that battlefield dynamics are such that cues older than 24 hours are generally not useful and that daily filtering will keep the CIDB manageable. The third filter is the mission filtering and is a crucial step just before interpretation. Just prior to a mission, cues are pulled that are pertinent to the upcoming mission and are sent to the ES computer as a mission packet. At this time the Data Base Manager must again carefully review the cues to ensure that the interpreters are not given distracting or meaningless cues lest the utility of the process be compromised. Mission filter criteria also include the SLAR areas of interest and any EEI and Frag collateral reports.

5.3.2 Map Generation and Storage

Accurate, up-to-date maps are essential to understanding the supported battlefield, and the EMC will prepare and store these maps for all areas of interest. EMC maps consist of an invariant terrain feature background and situation overlays. Situation overlays are described in paragraph 5.3.3.

EMC maps are prepared by tracing over paper maps to create an electronic replica in the EMC data base. This tracing is done using a digitizing tablet which resembles a drafting board. Although map digitizing is time-consuming since each line on a map must be traced and checked once completed, the map backgrounds are saved and can be used indefinitely.

Maps are displayed at the same scale as they are digitized, therefore any size map from a 1:10,000,000 hemispheric down to a 1:1000 street map can be digitized, stored and displayed. The EMC provides on-line storage for 30 maps while an unlimited number can be stored on magnetic tapes. On-line maps can be recalled for display in the ES or EMC in less than 5 seconds while maps on tape require 10 to 20 minutes to load and recall.

5.3.3 Situation Display Management

A situation display is a graphical representation of the area of interest. In the EMC, the situation display is a digital map background with electronic overlays containing the graphical situation data typically consisting of:

Situation data:

- Enemy Order of Battle (EOB).
- Friendly Order of Battle (FOB).
- Forward Edge of the Battle Area (FEBA).

Exploitation Aids:

- SLAR lines.
- Aircraft track and radar ground imaging area.
- Cued locations.
- Reported locations.

These overlays are developed by the situation analyst and can be selectively displayed on the map. Therefore, they need not show all data at the same time. Figure 5-5 is an example of a situation overlay.

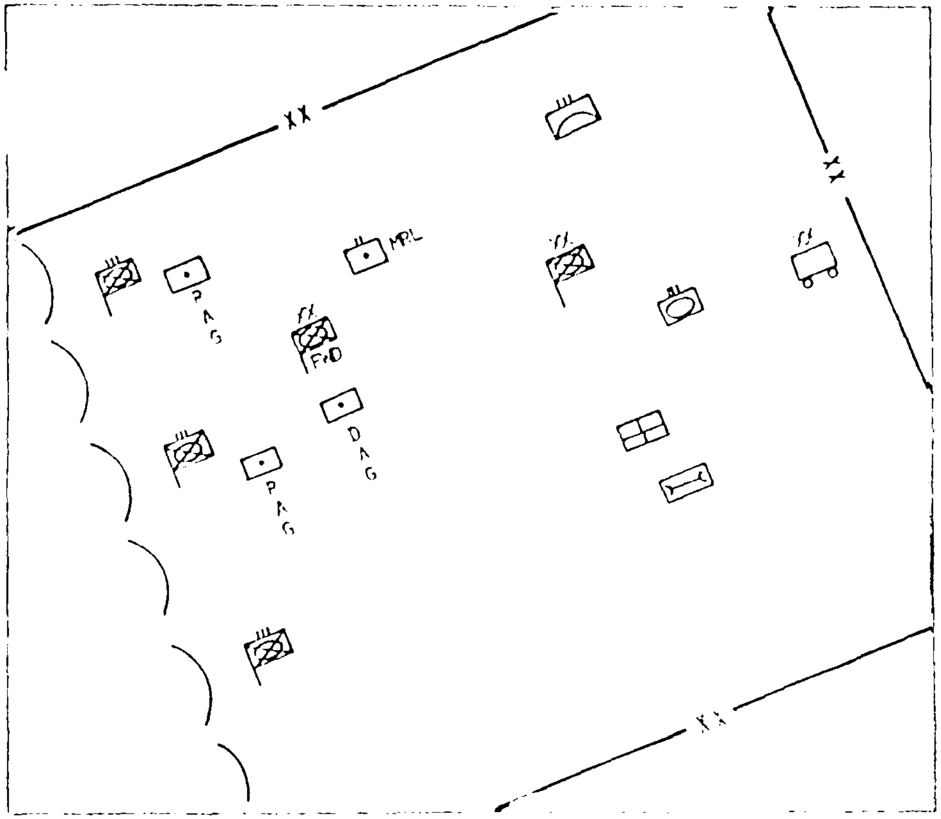

Figure 5-5 Typical Situation Map

In preparing the situation overlays, the situation analyst might use data from:

- Situation Reports (SITREPS) from tactical units (via Autodin).
- Tactics handbooks.
- Operations Orders (OPORDS) enemy/friendly paragraph.
- Cues and reports.
- Intelligence briefings.

It must be stressed that the job of developing a battlefield situation is the ultimate objective of all intelligence and reconnaissance and that the EMC situation analyst is not attempting to develop an intelligence product. Instead, the situation analyst is developing information that will provide general context information so that the image interpreter will be able to visualize how targets fit into the battlefield.

5.3.4 Administration

The EMC computer system provides the ABLE OIC with required administrative support. This administrative support is primarily record keeping for personnel, operations and logistics. Typical possible reports and records are shown in Figure 5-6.

Personnel/Administration

- o Personnel Roster
  A record of information about assigned, attached and supporting personnel. Typical data elements include name, rank, branch of service, specialty, date of rank, rotation date, local address, telephone (if any), rater, rating due date.

- o Shift Schedule
  A report listing the shift composition and schedule.

- o Alert Roster
  A report indicating the chain notification for events such as fire, equipment outages, change in DEFCON, dependent evacuation, etc.

- o On Call Roster
  A report listing is on call for maintenance or operation (probably part of alert roster).

- o Training
  Records containing information about the training status of assigned personnel, which should show training programmed, completed, etc.

Security

- o Access Roster
  A report of individuals with access to the complex. Data elements include name, badge number, security clearance, social security number, rotation date, access areas, etc.

- o Key/Combination Lists
  A report of people holding keys or combinations to various locked areas.

- o Emergency Plans
  Records of text for the following typical plans:
  --Fire Plan
  --Emergency Destruct Plan

Operations

- o Standard Operating Procedure
  Records of text files for storing, editing and publishing the system SOP.

- o Performance Reports
  Records perr[illegible]ing periodic performance reporting by the ABLE OIC. Exact reports and formats vary, but include be[illegible]al and textual representation.

- o History Logs
  Records indicating where various reference images are stored (SAPPHIRE phase history, image tapes, disks, etc.).

Logistics

- o Maintenance Data
  Records containing equipment maintenance data permitting following types of reporting:
  --Status tracking (what's up, down, etc.)
  --Reliability/Maintainability calculations
  --Trend Analysis of failures
  --Maintainer performance

- o Configuration Tracking
  Records containing information to define the hardware/software configuration and account for changes.

- o Hand Receipts
  Reports showing the accountable/responsible person for each piece of accountable equipment.

- o Supplies
  A system allowing for requisition, receipt and status reporting on supply items. Should support developing PLL requirement.

Figure 5-6 EMC Administrative Reports and Files

5.3.5 EMC Mode Activities

This paragraph describes the EMC personnel activities during each mode of ABLE operation.

5.3.5.1 Non-Mission. During non-mission periods, the situation analyst and data base manager will be updating/maintaining the CIDB and situation overlays. When these jobs are finished, time may be spent digitizing maps or training.

The NCOIC will be insuring that the administrative files are updated and supervising other ABLE non-mission activities. The OIC will probably be absent during non-mission periods, attending staff meetings, crew briefs/debriefs and coordinating base support.

5.3.5.2 Pre-Mission. Pre-mission activities in the EMC include the data base manager preparing the mission CIDB packet for the ES. The OIC will be conducting an ABLE pre-mission briefing based on the Frag and any briefing the OIC attended. Typical briefing format is shown in Figure 5-7. Although this is a comprehensive list, several things in the briefing such as report format and EEI will be Standard Operating Procedure (SOP) and will not normally be mentioned.

5.3.5.3 Mission. The EMC role during a mission is one of coordination and monitoring, unless there is a dynamic retasking. The situation analyst and data base manager will continue to update their data bases as required, adding reports as they are generated by the ES.

MISSION

LINE NUMBER

NUMBER OF AIRCRAFT, TAIL NUMBERS AND CREWS

SLAR LINES AND DIRECTION TO BE FLOWN

TAKE OFF TIME AND TIMES ON STATION

SITUATION

ENEMY FORCES

FRIENDLY FORCES

EXPLOITATION OPERATIONS

FRAG AREAS

EEI

REPORT INSTRUCTIONS

SPECIAL INSTRUCTIONS (SUCH AS
TELEPHONE REPORTING OF "HOT" TARGETS)

RADAR MODES AND ALTITUDES

ADMINISTRATIVE

REFERENCE IMAGERY

MAPS

Figure 5-7 Format of Typical OIC Pre-Mission Briefing

The NCOIC will monitor the aircraft track to insure that the correct lines are flown and will spend time coordinating with reconnaissance users, adjacent systems (such as TIPI) and the operations center. The OIC will be monitoring activity, looking for things to improve and handling VIP visitors. During missions, the EC will be controlling exploitation activities.

During a mission, a priority requirement may exist which requires retasking or retargeting. If this occurs, the EMC must coordinate the activities which include coordinating aircrew notification, alerting the ES, preparing new cues and developing a quick briefing. For dynamic retasking, the interpreters would be briefed in the ES using the remote situation display at the EC console.

5.3.5.4 Post-Mission. Post-mission activity in the EMC consists of logging mission data such as the imagery catalog, returning to non-mission activities and an OIC debriefing.

The OIC debriefing is intended to provide an operations critique and to develop ABLE inputs for collection tasking. As a result of this meeting, the OIC prepares an operations summary somewhat like Figure 5-8. This OPSUM will then be transmitted and the shelter returned to a non-mission status.

MISSION SUMMARY

FRAG REFERENCE
SORTIES
SLAR LINES
DATE/TIME

EXPLOITATION PERFORMANCE

AREA EXPLOITED
TARGETS FOUND
REPORTS TRANSMITTED
AVERAGE REPORT TIME

RECOMMENDATIONS

NEW FRAG AREAS IF ANY

Figure 5-8 Format of Typical OIC Post-Mission Debriefing

5.4 SAPPHIRE Operations

The operational functions required of the SAPPHIRE system are crucial to successful ABLE operations because SAPPHIRE produces the imagery from the radar signals.

5.4.1 Non-Mission

During non-mission periods, the SAPPHIRE operator functions include:

- Verifying that any required maintenance is performed.
- Locating and running image tapes for ACDS or ES to load new reference data base.
- Training support.
- System demonstrations.

5.4.2 Pre-Mission

The SAPPHIRE operator pre-mission activities include:

- Attending mission briefing.
- Mounting required blank tapes, verifying recorder functions.
- Checking equipment and setting required controls.
- Testing communications with data link and other systems.
- Testing intercom.

5.4.3 Mission

The SAPPHIRE operator is responsible for image quality monitoring during missions. This is accomplished by monitoring the SAPPHIRE image

display, advising the EC/OIC via intercom whenever degradation occurs, and activating a manual control to suppress transmission to the ACDS of degraded imagery. The SAPPHIRE operator is also responsible for recording imagery on magnetic tape, assessing the quality of taped imagery and maintaining logs of available taped imagery.

5.4.4 Post-Mission

After the OIC states that a mission is completed, SAPPHIRE operator activities include:

- Dismounting tapes and labeling them.
- Logging the tapes.
- Informing the EMC via intercom of the tape identification.
- Preparing maintenance requests for any problems noted during operations.

5.5 ACDS Operations

The ACDS provides ABLE a potential for large productivity improvement over manual systems by directing the screening interpreters to potentially lucrative target areas. The ACDS is also the primary storage for reference imagery during missions. The ACDS is an automated system requiring minimum operator control as shown in the following descriptions.

5.5.1 Non-Mission

During non-mission period, the ACDS operator duties include:

- Verifying that any required equipment maintenance is performed.
- Performing necessary file maintenance on the image data bases.
- Supporting training and demonstrations.
- Converting mission to reference imagery (as required).

5.5.2 Pre-Mission

The ACDS operator pre-mission activities include:

- Insuring that the correct reference imagery is loaded into the ACDS data base from the SAPPHIRE image tapes.
- Attending the mission briefing.
- Checking equipment operation.

5.5.3 Mission

The ACDS operator is responsible for monitoring ACDS operation and especially image registration. Since the ACDS operator will see imagery about 10 seconds before the EC, the ACDS operator is in a good position to warn the EC of upcoming registration loss so that corrective action can be taken by the EC. The ACDS operator may also make recommendations to the EC on settings of the ACDS parameters for maximum effectiveness.

5.5.4 Post-Mission

After the OIC states that a mission is completed, the ACDS operator activities include:

- Logging the contents of the image data base and reporting this information to the FMC.

- Preparing maintenance reports to list any problems noted during operations.

5.6 ES Operations

The exploitation subsystem provides the capability to interpret radar imagery and generate target reports. To accomplish the mission objectives, personnel are organized into three different but related job functions. These job functions are image screener, detail analyst, and exploitation controller. In APLE, the screener and detailer functions may be performed by any operator at any station. However, the normal assignments will be four screeners, two detail analysts and the exploitation controller. This section describes the tasks to be performed by personnel in each job function for each mode.

5.6.1 Non-Mission

The non-mission ES functions consist of verifying that maintenance is performed, training, capability demonstrations, reference image calibration, and operator maintenance. The first three activities are self-evident, while reference image calibration is discussed in the following paragraphs.

Constructing reference imagery from mission imagery will be done during non-mission periods when directed by the OIC. This process is under direction of the EC and consists of:

- Identifying the source of the imagery (see Figure 5-9).

LOCATION	FORMAT	MEDIA	ESTIMATED CAPACITY
SAPPHIRE	UNPROCESSED PHASE HISTORY	TAPE	UPD-4: 2500 NM^2/REEL UPD-6: 20000 NM^2/REEL
SAPPHIRE	PROCESSED IMAGERY	TAPE	UPD-4: 2500 NM^2/REEL UPD-6: 20000 NM^2/REEL
ACDS	MISSION IMAGERY	DISK	3 IMAGES TOTALING 1500 NM^2
ACDS	CALIBRATED REFERENCE IMAGERY	TAPE	UPD-4: 2500 NM^2/REEL UPD-4: 20000 NM^2/REEL
ACDS	REFERENCE IMAGERY	DISK	10 IMAGES TOTALING 1500 NM^2
ES	REFERENCE IMAGERY	DISK/TAPE	IMAGE TAPES STORED IN EMC

Figure 5-9 Imagery Storage Locations and Capacities within ABLE

- Determining the utility (quality) of the mission image to be used as reference.
- Developing a list of identifiable control points from maps, photographs and other sources.
- Calibrating the reference image by locating and marking the control points.
- Reporting via intercom to the EMC that a reference has been prepared, what it contains, and where it is located. The EMC will log this data in the image catalog.

5.6.2 Pre-Mission

The EC and assistant EC will attend the pre-mission briefing in the EMC. The remaining interpreters will perform system initialization and operator make-sure tests during this time.

The EC and assistant EC will brief the interpreters on the mission based on the OIC briefing. This briefing will include elements such as those in Figure 5-10.

After the briefing, the ES staff will perform a series of equipment checkout activities, and the EC will configure all stations to support screening/detailing functions. The EC will also establish alternate configurations and designate an alternate EC station. The EC will verify that the correct reference imagery is loaded in the ACDS and ES (if applicable) by viewing portions and comparing them with the map.

FRAG AREA SLAR/LINES

RADAR PARAMETERS

EEI

ENEMY/FRIENDLY SITUATION

REPORTING FORMAT (DIFFERENCES FROM SOP)

OPERATORS ASSIGNMENTS AND ES CONFIGURATION

OTHER INFORMATION AS APPROPRIATE

Figure 5-10 Format of Typical EC Pre-Mission Briefing

5.6.3 Mission

The basic ES flow during an imaging pass was illustrated in Figure 5-3. The following sections will describe the operator's functions during the exploitation process.

5.6.3.1 Initialization and Registration. Aligning the mission and reference images is crucial to successful screening and hence interpretation. When both images are correctly aligned, differences in the two images are immediately visible to the interpreter as a blinking spot when the images are alternately displayed (flickered) on the interpreter's display.

The exact procedure for registration depends on whether the ES mission image source is the ACDS or SAPPHIRE in the direct mode. However, the general procedure for both sources consists of:

- Identifying conjugate points in both mission and reference images.
- Designating these points with the light pen.
- Directing the ACDS (when used) to attempt registration.

Once established, the ACDS will maintain image registration automatically unless there is a break in the mission imagery. In the direct mode, occasional manual registration updating will be required to compensate for changes in aircraft flight paths.

5.6.3.2 Exploitation. The ABLE system uses a two-stage exploitation process in order to handle the large imaged area which the real-time SLAR produces. Screening is the first stage in which an interpreter views a portion (typically 2.5 NM wide) of the imaged area and selects potential target scenes for later detailed analysis. Detailed analysis is the second stage and consists of interpreting the selected scenes and writing appropriate reconnaissance reports.

A typical ABLE operating procedure will be to use four IIs, each screening one-fourth of the 10-mile UPD-4 swath. However, a major objective of the ABLE experiments will be to see if automatic change detection/cuing will improve screener productivity and allow the use of two or even one screener. Two II would be initially assigned to detailing with the four screeners becoming detailers after the real-time imagery has been screened. The EC will initially view the full swath as a screener to monitor the overall mission.

5.6.3.2.1 Screener Functions. The major function of the image screener is to view relatively large sections that have cuing information overlaid on them so as to select relevant sub-frames of this imagery for interpretation by the detail analyst. Through this division of labor, the screener minimizes the amount of irrelevant imagery provided to the detail analyst, thus allowing the analyst to spend time more efficiently on the interpretation of pertinent imagery.

Once imagery starts to be received, the screener is ready to participate in registering the mission imagery in order to permit change detection. The registration process was described in paragraph 5.6.3.1.

The primary task of the screener after registration is to select potential areas as the mission imagery moves by on the display screen. To assist in performing this task, there are four analytical aids: variable screening rate, ACDS cues, cue symbols from the EMC CIDB and flicker change. The screener will search the imagery using any or all of these aids while the cognitive tasks of pattern recognition and return counting will be the primary interpretation methods.

To further enhance the image screener's performance on this primary task a situation display (map) is available. The situation display will contain a limited amount of information such as map overlays, control boundaries, tasking areas, aircraft track and other graphics.

Once the screener has determined that a potential target area is present in the mission imagery, the light pen is used to designate it. The designation will appear as a graphic (diamond) symbol indicating that the designated area in the imagery should be interpreted in greater detail. When the screener presses the screen with the light pen, the imagery containing the target and annotation will automatically be stored in the buffer along with the reference imagery. The image will be centered on the target when it is stored. The screener will continue to search the imagery to detect and locate potential target areas until the last frame of the mission imagery is scrolled on the screen.

Should the screener believe that an area contains a particularly lucrative or time sensitive target, it may be designated as a priority scene which will cause it to be put at the front of the detail analyst queue. In addition, designated scenes which are within the boundaries of a tasked area will be automatically placed at the front of the queue.

Once all the imagery for a particular mission is displayed, the screener will reconfigure the station to perform detailed analysis and/or secondary analysis.

5.6.3.2.2 Detail Analyst Functions. The major function of the detail analyst is to interpret radar imagery in order to identify targets of tactical significance. The detail analyst's major tasks are image retrieval, target detection, target classification and identification, target location, and report generation.

The detail analyst will retrieve each frame by pressing a specified PSA. These frames will be prioritized according to a first-in/first-out basis, unless assigned a higher priority by the screener or the system for tasking area targets. The imagery in each frame will be stationary and may be displayed at a resolution higher (10 foot) than that of the screening station (20 foot).

Once the imagery is retrieved and displayed, the detail analyst will select from two types of interpretation aids: analytical aids and collateral information. First, the following analytical aids will be available: target cues (overlaid on mission imagery), previous target reports, flicker change detection, intensity controls, and mensuration capabilities.

The detailer will also refer to collateral information to assist in performing the interpretation task. This will be done by issuing a request for collateral information to the ES control computer containing the CIDB mission packet. This computer data base will be searched for all data within the boundaries of the displayed image and the text data made available to the SRD alphanumeric display. While performing the overall interpretation task, the analyst may also monitor the situation display containing collateral information in graphic form.

The interpretation process will result in a determination of change (such as existence, absence, movement) and relevance of a target. If the targets contained in the mission imagery are recognized as important, the detail analyst will perform classification and identification (if possible) of targets. However, if the targets are judged as unimportant or non-military, the analyst will retrieve another frame of mission imagery for interpretation.

If a target in the imagery scene is recognized as important, the detail analyst will position the cursor over the target and press a PSA assigning a graphic symbol (triangle) to the target.

To determine the location of the target or any other feature, the detail analyst may press a specified PSA and position the crosshair on the target, to compute and display the target coordinates (UTM, Lat/Long) in order to inspect them. Target coordinates are automatically inserted into the report format when the target is designated.

Once a target or number of targets in the selected imagery frame is classified/identified and located, the detailer will generate a target report according to a predetermined format. The detailer will press a key and the report skeleton will appear with blanks for variable report information. This information will then be typed in and reviewed. Standard phrases are available on the PSA and most reports can be composed without actually typing.

Once the report is composed, the detailer transmits it through the EMC to the ABLE users. At this point, the detailer may also print the image on a hardcopy printer and/or have it placed on an archive tape. The report will be reviewed at TIPI prior to transmission to users. Once a target report is transmitted, the detailer continues to interpret the same frame of mission imagery or may select a new frame of mission imagery. However, once all mission imagery has been interpreted (buffer empty), the EC may direct the detailer to conclude the mission or to prepare for another SLAR line.

5.6.3.2.3 Exploitation Controller Functions. The major functions of the exploitation controller are to supervise the activities of personnel located in the exploitation subsystem. To accomplish this overall task, the EC has a voice communication system, a standard display station, and a large situation display. This will enable the EC to interact via phone or intercom with personnel in the ES, the EM and other ABLE subsystems. The EC can view mission imagery displayed on any screener/detail analyst screen as well as view collateral alphanumeric information. During a mission, the activities of the EC can be grouped into tasking and monitoring. These tasks are described below.

Tasking. The exploitation controller will determine the most efficient division of labor which will result in the effective analysis and interpretation of the incoming mission imagery. If the workload warrants, the EC can redesignate assignments and reconfigure the system to support the new screener or detail analyst mixture.

Monitoring. The exploitation controller will monitor system operations and take corrective action as required. Figure 5-11 lists typical activities monitored and potential problems.

5.6.3.2.4 Assistant Exploitation Controller. The Assistant EC will normally function as a screener/detailer with additional responsibilities for assisting the EC.

ACTIVITY MONITORED	ATTRIBUTE	SOURCE	CORRECTIVE ACTION
ACDS PEFORMANCE	NUMBER OF DETECTED CHANGES	SCREENERS	ADJUST CLUSTER SIZE
REGISTRATION	ACDS LOSS OF LOCK OR MISSION/REFERENCE ORIENTATION	ALPHANUMERIC CONSOLE SCREENERS	RE-ACQUIRE ADJUST REGISTRATION
RADAR	PROPER LINE, RADAR MODE, ETC.	SIT DISPLAY	NOTIFY AIRCREW VIA CHANNELS
ES BACKLOG	FRAMES IN IMAGE BUFFER	A/N DISPLAY	RE-ASSIGN PERSONNEL
ES THROUGHPUT	SCREENING RATE RELATIVE TO AIRCRAFT	SIT DISPLAY	ADJUST SCROLLING RATE RE-ASSIGN PERSONNEL

Figure 5-11 EC Monitoring Functions

5.6.4 Post-Mission

Post-mission activities in the ES will consist of completing detail analysis, logging of activities, and reporting maintenance required. Additionally, the EC may choose to re-exploit some of the imagery from the previous mission by replaying the mission imagery from either the ACDS or SAPPHIRE (see Figure 5-9). In cases of re-exploitation, the process is the same as for a mission except that the imagery source is storage rather than on aircraft.

APPENDIX A

GLOSSARY ACRONYMS

AAFCE	Allied Air Forces Central Europe
ABLE	Advanced Building Block for Large Area Exploitation (ABLE-1)
ACDS	Automatic Change Detection System
A/N	Alphanumeric
ARLO	Army Liaison Officer
ASIC	All Source Intelligence Center
ATAF	Allied Tactical Air Force
ATOC	Allied Tactical Operations Center
AUTODIN	Automatic Digital Network
BIM	Beta Interface Module
CDC	Control Data Corporation
CIDB	Collateral Information Data Base.
C/N	Clutter-to-noise
COIC	Combat Operations Intelligence Center
CONUS	Continental United States
CRT	Cathode Ray Tube
DBM	Data Base Manager
EC	Exploitation Controller
EEI	Essential Element of Information
ELINT	Electronic Intelligence

EMC	Exploitation Management Cell
EOB	Enemy Order of Battle
ES	Exploitation System
FACSUM	Forward Air Controller Summaries
FEBA	Forward Edge of Battle Area
FOB	Friendly Order of Battle
Frag	Fragmentary Orders
FRG	Federal Republic of Germany
FTB	Flexible Test Bed
HUMINT	Human Intelligence
IF	Intermediate Frequency
II	Image Interpreter(s)
IPR	Impulse Response
IR	Infrared
MARRES	Manual Radar Reconnaissance Exploitation Segment
MBS	Megabytes per Second
MIBARS	Military Intelligence Battalion Aerial Reconnaissance Support
MTI	Moving Target Indicator
NATO	North Atlantic Treaty Organization
NCOIC	Non-Commissioned Officer in Charge
NM	Nautical Miles (6076.1 feet)
OIC	Officer in Charge
OPORDS	Operations Orders

OPS	Operations
OPSUM	Operations Summary
Pixel	Picture Element
PPIF	Precision Photographic Interpretation Facility
PSA	Programmable Switch Assembly
QRC	Quick Reaction Contract
QSR	Quick Strike Reconnaissance
REFORGER	Annual Exercise to Demonstrate the Concept of Dual-Basing U.S. Military Forces for NATO
SAPPHIRE	Synthetic Aperture Precision Processor, High Reliability
SAR	Synthetic Aperture Radar
Shelter-1	QRC 76-01 Data Link Receiver Station
Shelter-2	QRC 76-01 Near Realtime Exploitation Station
Shelter-3	QRC 76-01 Realtime Exploitation Shelter
SIGINT	Signal Intelligence
SITREPS	Situation Reports
SLAR	Side-Looking Airborne Radar
SOP	Standard Operating Procedure
SRA	Selected Radar Activity
SRD	Software Reconfigurable Display
TARRRS	Theater Army Reconnaissance, Request and Reporting System
TEREC	Tactical Electronic Reconnaissance
TFC	Tactical Fusion Center
TIPI	Tactical Information Processing and Interpretation (TIPI-A)

TOT	Time-over-target
TRW	Tactical Reconnaissance Wing
TUOC	Tactical Unit Operations Center
USAFE	United States Air Force in Europe

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